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IMPLICATIONS OF RESEARCH FOR TEACHING TYPEWRITING. DELTA PI EPSILON RESEARCH BULLETIN 2.

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DESCRIPTORS- *TYPEWRITING, *BUSINESS EDUCATION, *TEACHING METHODS, *EDUCATIONAL RESEARCH, TEACHING PROCEDURES, TEACHING TECHNIQUES, LEARNING PROCESSES,

INTERPRETATIONS AND RECOMMENDATIONS BELIEVED TO BE SOUNDLY SUPPORTED BY RESEARCH, ARE PRESENTED IN THIS NONTECHNICAL REPORT. THE MATERIAL SHOULD BE ESPECIALLY USEFUL IN METHODS COURSES AND SHOULD BE A VALUABLE REFERENCE FOR TEACHERS OF TYPEWRITING. STUDENTS SHOULD NOT PRACTICE ON ISOLATED LETTER SEQUENCES OR ON A LIMITED VOCABULARY. WITH RESPECT TO MATERIALS, PRACTICE SHOULD BE EXTENSIVE RATHER THAN INTENSIVE. TEACHER PACING OF THE STROKING ALLOWS THE LEARNER TO GET SET FOR AND TO ORGANIZE HIS MOTIONS. THIS IS HELPFUL WHEN USED SPARINGLY AND ONLY DURING THE EARLIEST STAGES OF LEARNING. THE BASIC STRATEGY FOR LEARNING THE KEYBOARD IS TO SELECT FOR FIRST PRESENTATION A GROUP OF LETTERS THAT PERMITS THE IMMEDIATE USE OF REGULAR WORD AND SENTENCE COPY. EARLY EMPHASIS ON SPEED IS SUPERIOR, BOTH IN THE SHORT AND IN THE LONG RUN, TO EARLY EMPHASIS ON ACCURACY OF TYPESCRIPT. THE MATERIALS FOR SPEED PRACTICE SHOULD ALWAYS CONSIST OF REGULAR LANGUAGE COPY AND NOT OF SPECIALLY CONTRIVED DRILL MATERIALS. SPEED PRACTICE MATERIALS SHOULD BE MARKED SO THAT EACH PERSON IS AIMING AT A GOAL ONLY SLIGHTLY (TWO TO FIVE WORDS) ABOVE HIS ORDINARY RATE. JOB-TYPE ACTIVITIES SHOULD BE STARTED BY THE MIDDLE OF THE FIRST SEMESTER AND COMPRISE MOST OF THE CONTENT IN THE SECOND SEMESTER IN A 1-YEAR COURSE, AT LEAST 80 PERCENT IN THE THIRD SEMESTER, AND MORE THAN 90 PERCENT IN THE FOURTH SEMESTER IN A 2-YEAR COURSE. SUGGESTIONS FOR EVALUATION ARE INCLUDED. THIS DOCUMENT IS AVAILABLE FOR 50 CENTS FROM DELTA PI EPSILON, GUSTAVUS ADOLPHUS COLLEGE, ST. PETER, MINNESOTA 56082. (PS)

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**Implications of Research for**
**TEACHING TYPEWRITING**

## CONTENTS


Preface ..... i

Contents ..... ii

Author's Note ..... iv

The Acquisition of Typewriting Skill ..... 2
- The Orders of Stroking Habits ..... 2
- Early Use of a Wide Vocabulary in Practice Materials ..... 4
- The Role of Repetitive Practice ..... 5

Developing Stroking Technique ..... 6

Learning the Keyboard ..... 7
- Practice Procedures ..... 7
- Learning Numbers and Special Characters ..... 10

Speed Building ..... 11
- Speed Building Materials ..... 11
- Speed Building Procedures ..... 12

Accuracy Development ..... 13
- Some Useless Procedures ..... 13
- Copy-Reading Habits ..... 14
- Effective Accuracy Procedures ..... 14
- Distribution of Speed and Accuracy Practice ..... 16

Applying Basic Skill to Job-Type Activities ..... 17
- Introduction of Job-Type Activities ..... 18
- Materials for Job-Type Activities ..... 19
- Distribution of Skill-Building versus "Application" Practice ..... 20

Evaluation of Performance ..... 23
- Straight-Copy Work ..... 24
- Job-Type Activities and Production Tests ..... 27
- Standards and Bases for Grading ..... 29

Summary ..... 31

Selected References ..... 33

## AUTHOR'S NOTE

The recommendations for typewriting instruction contained in this pamphlet are based on two major sources of evidence: (a) research on methods and materials of instruction carried out in typewriting classrooms and on (b) *basic* principles for learning arising from the findings of the experimental psychology of learning. The psychological data are used, on the one hand, to support the classroom findings and, on the other, to furnish a basis for instructional procedures on issues which either have not been investigated at all in the typewriting classroom or on which the classroom research is for one reason or another undependable.

In any event, the present recommendations are based on what the author considers to be reputable evidence without regard to the extent to which these recommendations may or may not be in accord with current practices. Finally, the recommendations arise from critical and evaluative examination *at first hand* of hundreds of relevant studies from the earliest years through June, 1960. This is not to suggest that the present recommendations constitute final and irrevocable answers. It is not uncommon for new research to revise the findings of earlier research. At the same time, there is no option but to behave in accordance with the best evidence currently available.

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Southern Illinois University

December, 1961

# TEACHING TYPEWRITING

Typewriting is writing by machine. Legible adult longhand is written at a rate of about 100 letters a minute. Ordinary typing rates are about three times that fast and range up to more than seven times as fast as ordinary longhand. Add to the feature of speed the perfect uniformity of characters and, therefore, the perfect legibility of typescript and it is easy to see why the typewriter has become the world's primary means of making written records.

In 1958, persons in full-time employment classified specifically as "stenographers, typists, secretaries" numbered nearly two and one-quarter million, or more than 3.5 per cent of the total labor force in this country (with nearly another half-million persons employed part time). Additional millions, not specifically so classified, are in occupations which include at least some use of the typewriter or of devices with essentially a typewriter keyboard. "Clerical and kindred workers" is the second largest of all major occupational groups (the largest for women), and the proportion of the total labor force in this category (15 per cent in 1958) has been increasing regularly. Further, there is personal, as contrasted with occupational use of the typewriter, the extent of which would be difficult to overestimate. In all, some seven to eight million typewriters are in use in this country, and sales in 1960 exceeded 100,000 units per month.

Enrollment in typewriting classes in the public high schools alone has risen steadily, as reported in four U.S. Office of Education surveys during the period 1913 to 1948. In 1913, about one in every eight high school students was enrolled in a typewriting class. In 1948, better than one in five (22 per cent) of all high school students was thus enrolled. Past trends suggest that today probably well over one in every four high school students is enrolled in a typewriting class. It has been estimated that as of high school graduation, approximately three of every five students have had at one time or another during sec-

ondary school attendance formal instruction in typewriting. Dr. Conant, in his widely publicized reports on the American schools, has, in fact, recommended that typewriting be taught to all students by the time they are graduated from high school.

From beginnings in the 1880's as a specialized skill for narrowly defined occupational use by relatively small numbers of persons, typewriting has become a generally used skill in numerous occupations and for a variety of personal uses as well. The typewriter has become a basic writing tool. The large and expanding market for instruction in typewriting makes it more important than ever before to bring reputable research findings to bear on the continuous improvement of instruction.

## THE ACQUISITION OF TYPEWRITING SKILL

Identification and derivation of sound instructional materials and procedures rest on correct analysis of the task to be learned. This analysis, in the instance of typewriting, is so basic to subsequent decisions that a few paragraphs will be devoted to the skill acquisition process itself.

### The Orders of Stroking Habits

The acquisition of skill is said to consist of mastery over a series of stroking habits. The successive levels or orders of stroking habits are defined by the number of consecutive motions that may be made without devoting conscious attention to each stroke in the sequence. The earlier stages are ones in which stroking responses are made on a letter-by-letter basis. Perception of each letter in the copy is the stimulus for each key stroke. This is referred to as a "low-order" habit.

Later, the learner begins to combine some of his strokes into series of motions, into little chains, without having to devote conscious attention to each letter in the series. For each such series, later responses in the series are made

not on the basis of perceiving each letter in the copy but, instead, on the basis of the "feel" of the preceding motion. Kinesthetic cues, not visual cues, become the basis for response. (Kinesthesis is the sensation of movement and position in muscles and joints and should not be confused with the sense of touch.) For example, in typing the word "the" as a *chained response,* the kinesthetic cues (the sensations of motion) which arise from striking "t" serve as stimuli for striking "h"; the sensations of motion arising from striking "h" serve, in turn, as stimuli for striking "e." As skill develops, there is a shift-over from dependence on external cues (letters in the copy) to internal ones (sensations of motion). Chained responses made on the basis of kinesthetic cues are referred to as "higher-order" stroking habits.

FACTORS INFLUENCING CHAINING. Whether any series of motions will be made in chained fashion rather than as a series of separate strokes depends on (a) the amount of practice given to the sequence (and this is ordinarily governed by its frequency of occurrence in the language) and on (b) the ease of making the particular motions involved. For example, *th* is readily typed as a chain not only because of its frequency of occurrence in common words, such as *th*e, *th*em, *th*eir, *th*en, wi*th*, o*th*er, etc., but also because the motions are made by the strong fingers of opposite hands. The sequence *ed*, on the other hand, is also highly common (past tense of regular verbs), but it is more resistant to chaining because the motions consist of consecutive strokes by the same finger. Such motions are more difficult and awkward than those made by fingers on opposite hands.

CORRECTIVES TO FOUR COMMON MISCONCEPTIONS. While the foregoing analysis of the orders of stroking habits and their bases may be fairly familiar to many typing teachers, four additional facts may serve to correct some prevalent misconceptions that have led to wasteful practices in the conduct of instruction. The *facts* are these:

1. ***Higher-order stroking responses, even at expert levels, do not consist of long chains but are limited, for the most part, to 2- or 3-letter sequences.*** Chains longer than that are mainly restricted to the small handful of very

high frequency letter combinations found in those highly common words which happen to involve mainly alternate-hand motions. There are probably not more than several dozen of these.

2. *Higher-order habits are acquired very slowly.* Even the 40-wpm. (words per minute) typist performs mainly on a letter-by-letter basis. His superiority over the 10-wpm. typist lies almost entirely in greater mastery over low-order, letter-by-letter stroking habits rather than in appreciable use of higher-order, chained responses.

3. *The orders of stroking habits have no necessary correspondence whatever with linguistic units such as syllable, word, and phrase.* When some chained response happens to correspond to a linguistic unit, it is merely coincidental. Most of the sequences typed as sequences consist of letter combinations which do not form syllables or words.

4. *No one order of stroking habits characterizes any typist at any post-beginner level of skill.* With orders of stroking habits properly labeled as 1-stroke, 2-stroke, 3-stroke, and so on, even experts type difficult sequences on a stroke-by-stroke basis (e.g., *piazza*). All typing (once past novice levels) consists of an interweaving of stroking sequences of varying length, not often exceeding two or three strokes in any one chain. With increasing expertness chaining is more frequent than at lower levels of proficiency, and 4- or 5-stroke chains *occasionally* appear. Even at advanced levels, however, chained responses are heavily punctuated by single-stroke responses.

## Early Use of a Wide Vocabulary in Practice Materials

The foregoing facts about the hierarchy of stroking habits suggest that one should not practice on isolated sequences or on a limited vocabulary, and that earlier acquisition of higher-order habits and economies in training time may be expected from the early introduction and continuous use of practice materials ranging over a wide vocabulary, in which words occur with their normal frequency.

The common practice of devoting large amounts of practice to the short and commonly occurring words, as words, contradicts the fact that the elemental unit for higher-order responses is the 2- or 3-letter sequence and that it is mastery over these sequences (as initial, medial, or final parts of words of varying lengths) that defines higher levels of skill. For example, it is not the word "*it*" which is to be mastered, but rather the sequence "*i-t*" as it may occur in such words as *it*, *it*em, l*it*tle, illic*it*, lim*it*a-tion.

## The Role of Repetitive Practice

Repetitive practice or drill is probably the most prevalent notion in the learning of skills, whether typewriting, piano playing, or other motor skills. In this connection the thing to guard against is *excessive* repetitious practice at relatively small units of material. Excessive repetition of acts is known to result in the accumulation of inhibitions, in increase in errors, in the fixing of undesirable responses, and in fatigue. One learns what one does; and the expectation that improved performance brought about by extensive repetitious practice on some particular materials will transfer appreciably to performance on other materials is demonstrably false. In typewriting, practice strengthens associations rather than increases speed of finger motions. Accordingly, one does not transfer faster motions produced by practice at some copy to copy containing other letter combinations and sequences. Transfer would apply mainly to the particular letter combinations practiced. In the light of the very large number of letter sequences in the language it may be recommended that, *with respect to materials, practice should be extensive rather than intensive*. For example, better one or two tries at each of ten sentences, say, than four attempts at each of five sentences. This precept applies at all stages of learning and for all purposes: to the materials used for keyboard learning as well as to those used for subsequent basic skill building and to those used to develop proficiency at real job activities.

## DEVELOPING STROKING TECHNIQUE

BALLISTIC MOTIONS. The key-stroking motion (like the motion in swinging a tennis racket or golf club or in throwing a baseball) is called *ballistic*. The finger is literally "thrown" at the key and carried through its course by the initial momentum. Ballistic motions cannot be made slowly. For the sake of good stroking technique, the individual key stroke must be a fast motion. Overemphasis on correctness of typescript at the start will tend to lead to hesitant motions, to pressing rather than striking of keys. The obvious way to force a fast individual motion, however, is to call for a fast overall stroking rate.

MUSCULAR TENSION. Efficient motions depend on the use of just the right amount of muscular tension. Instructions to type as fast as one can force the fingers are disadvantageous because this leads to excessive muscular tension. Instead, during the very earliest stages of practice, the teacher can pace the stroking. Very shortly, however, pacing should give way to the setting of individual speed goals just a little in advance of each learner's comfortable rate. In these ways the faster rates which lead to good stroking technique can be developed while avoiding excessive muscular tension.

PACING. Teacher pacing of the stroking allows the learner to get set for and to organize his motions and is helpful when used sparingly and only during the earliest stages of learning. Since pacing imposes a single rate—and any one rate will necessarily be either too fast or too slow for some members of a class—*excessive* pacing of the stroking violates individual differences.

VISUAL GUIDANCE FOR MOTIONS. Motions are best guided by sight when they are first learned; they tend to be hesitant and nonballistic when touch typing is insisted on from the start. Accordingly, watching the keyboard should be encouraged while practicing motions, and somewhat more extensive toleration of sight typing than is commonly the case can be expected to be helpful. *Touch*

typing using ballistic motions can be carried out only on the basis of kinesthetic cues, and it is known that kinesthetic cues are *not* available for use early in learning. The faster and less variable motions used under early sight typing will, in fact, speed the development of kinesthetic cues and sooner lead to full touch typing with good stroking techniques.

## LEARNING THE KEYBOARD

ORDER OF PRESENTATION. There is no particular order of presentation of keys that has been shown to be most advantageous. Starting with words and sentences using only the home row keys or with words and sentences using the stronger fingers will be easier for the student than immediately ranging all over the keyboard and should therefore have good effects on motivation. The basic strategy is to select for first presentation a group of letters that permits the immediate use of regular word and sentence copy.

RATE OF PRESENTATION. All 26 *alphabet* keys have been successfully "presented" (but this does not mean mastered) in one lesson. At the other extreme, about 15 lessons are typical, and more than that is, apparently, not thought necessary. There is no research evidence on this issue except the generalization that rate of presentation should probably be geared to the maturity and aptitudes of the class.

PRACTICE MATERIALS. For the earliest practice at new reaches there is no objection to a few moments (but not more) of "nonsense drill" of the *frf* variety. However, as a basic medium for teaching the keyboard, nonsense drill has been shown to be uniformly less effective than the immediate use of regular language materials.

### Practice Procedures

The task in learning the keyboard is to associate a particular finger motion with a particular letter in the copy

materials. The primary conditions for speedy formation of associations are: (a) minimum delay between perceiving the letter in the copy and making a stroking response to it and (b) minimum delay between response and reinforcement. That is, the learner must have some way of knowing, immediately after responding, whether or not his response is correct. Specific instructional procedures which best meet these conditions are:

EMPHASIS ON RAPID STROKING. Immediate emphasis on rapid stroking (at the temporary price of high accuracy of typescript) will force the learner to crowd strokes close together in time. This will, by definition, minimize delays between perceiving and responding and thus speed firm mastery over the keyboard. Of a substantial number of studies, none shows early emphasis on accuracy of typescript to be superior, and most show early emphasis on speed to be superior, both in the short and in the long run.

OVERT LETTER-BY-LETTER VOCALIZATION. Initially, spelling aloud as one strikes keys will aid keyboard learning *and* will foster good stroking technique. Such distracters as the noise of other typewriters and perception of other letters in the copy compete for the learner's attention. Overt vocalization of each letter as it is struck reduces potential interference from these other elements in the situation and, if carried out briskly (in sharp, clipped fashion), can help make the key stroke sharp and brisk instead of flabby.

At the same time the teacher must realize that vocalization is purely a crutch and that it should be encouraged only during the early keyboard learning stages. Vocalization enforces letter-by-letter stroking and, when overdone, holds back those who are ready to attempt a little chaining of responses. To eliminate letter-by-letter vocalization among those who appear to be clinging to it past the point of usefulness, the specific technique of word-by-word vocalization is helpful (but only with copy using very short words—because the beginner's skill precludes concurrent vocalization and stroking of anything but two- or three-letter words). The general technique is one of forcing speed—so that the learner has no time to vocalize.

GREATER TOLERANCE OF SIGHT TYPING. Furnishing the

learner with *immediate* knowledge of results is perhaps the first principle for learning. It has been established, however, that kinesthesis or "motion feel" is not available for use at the start of learning. Instead, dependence on the "feel" of a motion as an index of its correctness comes into play only *after* learning on the basis of visual cues has taken place. Insistence on strict touch typing from the start robs the learner of the necessary knowledge of results; and that which is furnished by permitting the learner to examine his typescript after a line or two has been typed is useless because it is too long delayed. Accordingly, speedier keyboard learning may be expected if learners are encouraged to watch the keyboard during the early stages of practice.

The typical sequence of behaviors is (1) to watch the keyboard; shortly thereafter (2) to watch the typescript in one's own machine; and finally, when kinesthetic cues become available as a source of reinforcement for responses, (3) to type by touch while watching the stimulus (i.e., copy) materials. To facilitate the earlier behaviors and to avoid the awkward process of having to look back and forth between copy and machine, *some part* of each class period during the first week or two can be devoted to typing from teacher dictation. Alternatively, learners can memorize small sections of copy from the textbook.

Although one small-scale study shows that early sight typing does not become habitual, there is, as yet, little accumulated experience on how to handle sight typing in the classroom. A dozen or more hours of typing under sight conditions is probably not excessive. Sight typing is a crutch for the early learning, and it may be expected to disappear as soon as the learner has firmer control over key locations. However, when for some learners sight typing persists past the point of usefulness, speed-forcing techniques (which deprive the learner of the time to look back and forth between copy and machine) may be expected to be an effective procedure for accomplishing the transition to touch operation.

The crucial requirement of a source of immediate reinforcement for motions demands that keyboards be lettered. In fact, one authority has remarked that the place for blank keyboards, key caps, and such is the rubbish

heap. There is no guidance so effective as that furnished by direct observation of the keyboard.

IMMEDIATE "CORRECTION" OF ERRORS. To disrupt any possible tendency to fix a wrong response, it is sound practice to follow it with a correct response. During keyboard learning stages, when the learner is not practicing under timed conditions, if he senses that he has made a misstroke, he should follow it with the correct stroke, or he should space once and retype the word in which the misstroke occurred. Errors he is not aware of cannot, of course, be treated in this way, and the learner should certainly not form the habit of watching his typescript continuously for the sake of "correcting" errors. Instead, the teacher's suggestion should be a casual one to the effect that if the learner happens to notice or to sense a misstroke immediately after it is made, he should follow the procedure indicated.

## Learning Numbers and Special Characters

Poor mastery over numbers and characters is a common complaint, and the teacher must decide whether it is worth the investment of practice time needed to bring proficiency over numbers to a level even faintly approximating mastery over the alphabet keys. One suggested solution is the so-called "pipe-organ" method of fingering, in which (for copy consisting only or mainly of numbers) one or both hands are placed on the number row as a home row. Studies of the "pipe-organ" versus traditional modes of reaching for top-row keys are inconclusive because of the concurrent use of a mixture of sight and touch typing by students under both methods. The foregoing contamination, despite unusually large amounts of practice devoted to number typing in these experiments, strongly suggests that the teacher who devotes class time to more prominent objectives may have more to show in the long run than the one who fussily insists (usually uselessly) on typing top-row keys wholly by touch right from the start. This is not to say that touch mastery over top-row keys is not desirable, but rather that it takes more practice time than it may be worth.

The most prominent cause of reported difficulty with top-row keys is that they tend to be underlearned, because underpracticed. Accordingly, reasonable mastery over top-row keys, whether by sight or by touch, requires frequent practice on copy including these keys throughout the entire course of learning.

## SPEED BUILDING

Basic stroking skill refers to the rate and accuracy of key stroking apart from decisions as to form and arrangement (such as those involved in typing a business letter or other real-job activity). In connection with practice aimed at increasing stroking speed and minimizing misstrokes it has been found that there is practically no relationship between speed and errors. Accurate and inaccurate typists are found at all levels of speed. This means that the factors that underlie rapid stroking are mainly different from those that underlie accurate stroking. Accordingly, the first principle for skill building practice is that one cannot build higher speed and better accuracy at the same time. Speed practice must be kept separate from practice for accuracy.

### Speed Building Materials

Higher speeds are *not* caused by faster motions. Instead, rates increase when the mind can sooner "tell" the fingers what motions to make. Stronger *associations* between copy materials and finger motions are required. This explains why the "figure skating" all over the keyboard called for by certain technical drills involving combinations of letters which do not occur in the language has failed to produce any measurable benefit. The associations developed in such materials are not the ones required for ordinary English. The materials for speed practice should *always* consist of regular language copy and not of specially contrived drill materials.

Since one wishes to build speed on the variety of letter sequences which exist in the language, the materials for speed building should range over a wide vocabulary. Increased speed on a limited vocabulary should not be expected to transfer completely to performance on a wider vocabulary with its larger range of letter sequences.

## Speed Building Procedures

RATE FORCING. Faster rates are the result of motions being crowded together closer in time, with less delay between motions. Therefore, practice must be such as to encourage closer crowding of motions. Under conditions of conscious and deliberate *forcing* of the rate, the learner stumbles on and "discovers" new and improved patterns of finger motions. The teacher must push for speed. He should not expect it "to take care of itself."

GOAL SETTING. Excessive striving for faster rates results in adverse muscular tensions and defeats its own purpose. Speed practice materials marked so that each person is aiming at a goal slightly above his ordinary rate (say, 2–5 wpm. above) will not only serve to prevent excessive tension, but will give each learner a specific speed goal in keeping with his proficiency. Specific and individualized goal setting has been shown to be superior to simply urging the learner to do "better" or "to improve his past performance." Goal setting of this sort applies, of course, to all aspects of training, not just to speed building.

Speed practice should not be accompanied by strict error maximums. Any speed building program which insists on high accuracy at the same time will accomplish very little—either by way of speed or accuracy.

DURATION OF SPEED SPURTS. Devoting much speed building practice to short spurts (typically, not exceeding one minute) is a popular fad without support either from general principles for learning or from any evidence in typing classrooms. One might start a speed building program with very brief timings, but if there is to be any appreciable transfer or carryover to performance over

longer intervals, the training program must provide for gradual increase in the duration of continuous typing under conditions of pushing for speed—eventually approximating the duration of typical job activities.

## ACCURACY DEVELOPMENT

The number of misstrokes in ordinary copy work is known to fluctuate considerably from minute to minute, from day to day, and from one occasion to the next. This attests to the enormous complexity of the factors that underlie accurate stroking. Unfortunately, with hardly any exceptions, the materials and procedures traditionally used to improve stroking accuracy have been shown to be quite without merit. The following procedures have been found to be, at best, doubtful and, at worst, harmful, for accuracy development.

### Some Useless Procedures

1. Technical drills containing non-sensemaking sequences of letters—either for preventive or remedial purposes.
2. Repetitious practice on the particular words mistyped—even in their phrase or line setting.
3. Error analysis charts or technique check sheets.
4. Rhythm drills, typing to music, or any other stroke-by-stroke pacing technique involving equal interstroke time intervals.
5. "Concentration" drills employing unusual or foreign words or jumbles of letters.
6. Use of "perfect" copy as a goal and repetition for the sake of perfect copy.
7. Stringent standards of accuracy early in learning.

Learners who ignore stroking errors have uniformly done at least as well as those subjected to one or another of the seven procedures listed above.

## Copy-Reading Habits

The use of "concentration" drills, as mentioned above, reflects inattentive reading as a source of some typing errors. "Attention" is one thing, however, and "reading habits" quite another. The teacher's plea that learners "pay attention to the copy" may or may not be effective. But, in any case, the typewriting teacher can do little about reading habits in and of themselves. Years of study of eye movements in a variety of tasks show that the reader gets his copy at whatever rate and in whatever manner will satisfy the demands of the task—whatever the task may be. In typewriting, measures of what is called the eye-hand span show that typists at all speeds read about one second ahead of their hands (so that the 12-wpm. typist, for example, reads about one stroke ahead of his hands). In a very real sense, it is not the reading habits that govern the stroking, but, instead, the stroking rate or level of stroking skill that governs reading habits. To suggest the reverse is to suggest that all the typist needs to do to type at 80 wpm. is to read at 80 wpm. On the matter of reading copy there is very little more the teacher can do than to urge learners to resist distraction while typing.

## Effective Accuracy Procedures

Authorities agree that in all perceptual-motor skills carried out at high rates, correctness or quality or *accuracy depends mainly on control over the timing of motions.* Conventional instructional procedures have tended to put the focus on specialized drill materials of various sorts. The proper focus is mainly on stroking habits rather than on practice materials. The reference here is to the concept of rhythm.

RHYTHM. Rhythm in typewriting refers to the pattern of time intervals between motions and is measured by the ratio of one interstroke interval to the next. These inter-

vals have been found *not* to be equal. Instead, they vary widely according to the relative difficulty of making any given series of motions. Insistence on metronomic time intervals (except for just a few minutes daily during the earliest stages of keyboard learning—as a means of aiding the learner to get set and organized for each motion) lands the learner on a plateau of letter-by-letter stroking from which it may be difficult to rise.

While the fallacy in metronomic tempos has been long understood, it should also be recognized that the "variable rhythms" which do characterize efficient typing are *not* directly teachable. Unfortunately, the rhythms of typing are not only as various as the number of different letter combinations in the language, but rarely can any particular pattern of interstroke intervals for any given sequence of letters be shown to be best for all learners. Efficient rhythms can neither be described in words nor very effectively demonstrated. Instead, each learner must "discover" for himself the most appropriate rhythms for him. Rhythm is primarily a function of right speed, and instructional procedures which guide the learner into typing at an appropriate rate will be those which engender efficient rhythms.

GUIDANCE FOR STROKING RATES. Another conventional instructional procedure consists of urging learners to "type for accuracy." This is a sort of "magic words" approach which, when unaccompanied by specific and concrete means of typing accurately, is about as useless as urging a small boy to keep his face clean. What is sorely needed, but not yet available, is a means of guiding each typist into that *specific* rate of stroking at which he can exercise adequate control over motions.

ERRORS ATTRIBUTABLE TO EXCESS SPEED. The preceding discussion refers to improving the accuracy of all typists at any and all stages of training. The present reference is to those few who make very large numbers of errors presumably attributable to excessive striving for speed and/or to grossly erratic timing of motions (as evidenced, for example, by grossly uneven shading of typescript, by "piling" of letters, *et al.*). For such persons, having them revert to stroke-by-stroke vocalization is

sometimes an effective remedial procedure. However, pronouncing each letter as its key is struck immediately brings all stroking back to elementary levels. Therefore, it must be used sparingly, only for a few minutes at a time, only for those who appear to need such practice, and only as a means of putting a brake on excessive rates or of reducing highly erratic timing of motions.

MINIMIZING SUBSTITUTION ERRORS. Most misstrokes consist of motions directed at an adjacent key. In fact, one basic need in early keyboard learning is plentiful practice in making the fine differentiation between the motion toward *r*, for example, and the one toward *t*, between the reach for *m* and for *n*, and so on. Therefore, immediately after completion of alphabet presentation, substantial amounts of practice by all students should be done on materials with a high concentration or density of adjacent-key strokes (and other commonly substituted letters) specifically built into them. The lines of copy focusing on each letter of the alphabet in turn, found in many typing textbooks, are not quite what is desired. Instead, one wants copy focusing on each letter, together with the letters commonly misstruck for the given letter. For example, copy materials for the *m-n* differentiation might read: *He manages an important company. Many men remained unmoved.*, etc. In other words, use materials which give the learner many opportunities to practice the differentiations for the commonly substituted letters (*r-t, m-n, o-i, e-i,* etc.).

## Distribution of Speed and Accuracy Practice

"Speed versus accuracy emphasis" has been a popular topic for research. During early keyboard learning stages, there is no option but to stress fast motions (but short of the point of excessive muscular tensions). This is not only because the ballistic motion which defines an effective stroke cannot be made slowly, but also because stress on speed shortens time intervals between perceiving the elements in the copy and making stroking responses. This, by definition, is a primary requirement for efficient learn-

ing of most tasks in this world, especially in perceptual-motor skills, and keyboard learning is no exception. The findings of typing research furnish good support for the foregoing generalizations.

At subsequent stages of training, the question of speed *versus* accuracy emphasis is entirely a pseudo-question. It is not a question of whether to emphasize one or the other objective, but of when and for how much time. The effects on speed and on accuracy depend on (1) the *amount* and (2) *distribution* of practice devoted to speed and to accuracy, and on (3) the *degree of emphasis* on each factor (i.e., how fast? how accurate?).

A number of investigations have been addressed to various patterns of different amounts of time devoted to speed or to accuracy practice and of different arrangements or orders of emphasis, introduced at various stages of training. The results vary with the variations in training arrangements. The general trend of the findings suggests, however, that substantial periods of attention to speed, followed by briefer focus on accuracy, produce better results than (a) much accuracy practice in relation to the amount of speed practice and than (b) approximately equal attention to speed and to accuracy.

The foregoing results are an inevitable consequence of the fact that the chaining of responses which defines higher-order habits can be brought about only by jamming responses close together in time. Given some reasonable amount of practice devoted to accuracy, following extensive speed practice, errors are typically brought down to the level of those who have practiced extensively for accuracy, while stroking speed remains superior.

## APPLYING BASIC SKILL TO JOB-TYPE ACTIVITIES

Simple copying without regard to matters of form and arrangement is referred to as "straight copy" work; and evaluation of basic stroking skill normally consists of measures of speed and errors made in straight copy work. Straight copy skill is, of course, not an end in itself, but a means to an end. One "applies" basic stroking skill to

real-life typing activities which add the new component of decisions regarding the form and arrangement of what is typed. As contrasted with "basic stroking skill" and with "straight copy" work, these activities may be termed "application work," in which basic skill is *applied* to such personal and business "jobs" as preparing correspondence, tables, manuscripts, memos, forms, etc.

The widely used term for these activities is "problem typing," but the term is an unfortunate one because very rarely is any of the activities mentioned a "problem" in the true sense of the word. "A problem . . . exists when (one's) activity has a goal but no clear or well-learned route to the goal. He has to explore and find a route." The vast majority of all typing activities are carried out on the basis of a fixed and well-learned routine or series of specified steps. They are rarely "problems," and do not call for "problem solving behavior." It is therefore recommended that the term "job-type activities" be used instead of "problem typing."

Thus, "application work" is done on "job-type activities." When such work is done on a large scale, with substantial output over an extended period of time (the better part of an hour as a minimum), then and only then are such activities properly labeled "production work."

There is, as it happens, no typing research whatever on instructional procedures (i.e., teaching methods) for job-type activities. The few comments that may be made are based entirely on basic principles for learning.

## Introduction of Job-Type Activities

The learner cannot profitably undertake application work when his level of sheer stroking skill is such that he needs to devote much of his attention to key stroking. Little more than simple centering and, perhaps, envelope addressing may be effectively taught before the learner has reached a *gross* stroking rate on new straight copy materials of about 20 wpm. The longer one waits to introduce job-type activities, the higher the stroking skill the learner will bring to these activities, and the more rapidly

will matters of form and arrangement be mastered. For one thing, however, an unadulterated diet of ordinary skill building for weeks on end grows tiresome and tends to have adverse effects on interest and motivation. For another thing, large amounts of time are needed to develop proficiency on the many different sorts of job-type activities normally incorporated into typing training programs. The case for relatively early introduction of job-type activities is especially strong in programs restricted to one or two semesters of training. Accordingly, a compromise between optimal conditions and practical considerations must often be made.

Longer programs permit later introduction of job-type activities. However, it is indefensible—purely on the grounds of having a two- or three-year training program available—to defer job type activities past the point at which straight copy proficiency suggests they may profitably be introduced. Under any effective basic skill building program (i.e., one in which early stress is on stroking speed) 20–25 wpm. *gross* stroking rates (for five minutes on new copy) can be developed, on the average, in about five weeks and, for practically all learners, certainly by eight to ten weeks (middle of first semester). This is not too early a point to begin work on what is typically the first job-type activity—simple correspondence.

## Materials for Job-Type Activities

Since the new element in any job-type activity is its form or arrangement, the early practice materials should be such as to permit maximum practice on those elements representing form, with a minimum of straight typing. Thus, the early personal or business letters should contain exceptionally and even artificially short bodies—one or two brief sentences in the body of the letter are sufficient. This will permit maximum practice on those elements outside the body which make up the aspects of "form." This is the new item in the learning, and it is a simple and straightforward case of focusing the practice on the new features to be learned. When the location of elements

in a letter has been well enough learned so that little conscious attention need be devoted to their location, then the practice materials may be made more typical—with respect to length of body, for example.

This principle may be extended to all job-type activities. As another example, the early work on planning and typing tables should use artificially short ones so that maximum practice may be given to the planning aspects.

## Distribution of Skill Building versus "Application" Practice

In recent years evidence has been accumulating that sheer stroking power as developed in speed and accuracy exercises and as measured by proficiency at straight copy work makes a relatively modest contribution to proficiency at job-type activities. Here are some sample findings:

1. When a large variety of job-type activities described as being of "typical difficulty" was presented to students in unarranged form—so that the typist had to make his own decisions as to form and arrangement—third-semester classes which had spent all of that semester in practice at job-type activities substantially outscored classes which had spent two-thirds of that semester on straight skill building and one-third at job-type activities. The "production" rate of the former group was raised from 5 to 13 wpm.; of the latter group, from 5 to 8 wpm. In addition, the two groups did not differ in their straight copy proficiency even though one group of classes had spent no time at direct skill building practice. Another way to express the contrast is that the average "production" rate of the classes spending all their practice time at job-type activities was 28 per cent of their straight copy rates; while that of the other classes was 17 per cent of their straight copy rates.

2. The findings described in the preceding paragraph apply to the turning out of job-type activities wholly free of any errors that would make them unacceptable or unmailable. In another investigation involving five different wholly unarranged job-type activities of appreciable difficulty and in which speed of work was scored separately

from quality of work, straight copy proficiency accounted for one-fourth of the rates on these job-type activities and had practically zero relationship to the quality of work on these job-type activities. The three classes in this investigation had spent 80 to 90 per cent of their training time at job-type activities.

3. There have been reports of "production" activities carried out at more than 80 per cent of straight copy rates. What is inexcusably omitted in these reports is that the figures refer to work in which either the "problems" were fully arranged in advance, so that the learner had only to copy, or in which the measurement of performance was not begun until after the planning had been completed, or in which there was no erasing and correcting of errors —so that the measurement did not include the time spent in planning and in decision making or in identifying and correcting mistakes.

4. When, over a 4-week period, 81 employed typists were given ten minutes a day of speed and accuracy drills right at their work stations, their straight copy proficiency was significantly improved over that of a matched group of employed typists not given such special practice. But these drills had no apparent effect on the production proficiency of these two groups of typists as measured over an entire week's output immediately following the 4-week period. The group not given the speed-accuracy drills turned out as much actual work in a week as the group subjected to the drill practice. Increases in straight copy proficiency had no transfer effect on performance on real job activities.

5. The most striking evidence of all is from a study in which, after a 6-week period of keyboard learning, one beginning class spent the next fourteen weeks going from a few minutes of warmup directly to the job-type activities in the lesson (omitting *all* speed and accuracy exercises and drills), while an opposed class followed the textbook exercise by exercise and lesson by lesson, doing the appreciable amounts of "drill" work incorporated into typical first-semester lessons. At the end of the semester, the two groups were equally proficient at straight copy work! Unfortunately, the investigator did not also test the two groups on job-type activities.

THE FACTORS UNDERLYING JOB PROFICIENCY. The contribution of sheer stroking power to performance at job-type activities requiring that the typist make his own decisions on matters of form and arrangement ranges from negligible to modest. For the most part, proficiency at job-type activities rests more on the ability to make correct and rapid decisions on matters of form and arrangement, on the ability to recognize errors when they do occur and to erase them neatly and with dispatch, on the ability to handle paper and supplies, and so forth, than it does on sheer stroking power as measured by straight copy performance. This is not to say that sheer stroking power is of no account, but rather that once sufficient stroking power to sustain "application" work is developed, the proper interest is in proficiency at job-type activities.

There are, of course, many real-life typing activities that do not require decision making by the typist and/or in which he copies pre-arranged materials. Higher straight copy skills no doubt make a greater contribution to such tasks than they do to tasks requiring decision making by the typist. Even so, direct practice at such activities—rather than at straight copy materials—is called for. We learn to type envelopes by typing envelopes; to type manuscripts by typing manuscripts; to copy a pre-arranged table by copying pre-arranged tables, and so on. The "payoff" from practice at jobs in their entirety and in their natural setting will be greater than that from prior practice at the isolated component of ordinary stroking skill.

Accordingly, the proportion of training time devoted to sheer stroking skill and the use of timed writings for evaluation should decrease at an increasing rate as training progresses. As a rough approximation it may be suggested that (a) job-type activities be begun by the middle of the first semester of training; that (b) in a one-year course, most of the second semester—and in a two-year course, not less than three-quarters of the second semester—be devoted to job-type activities; and that (c) in a two-year course, at least 80 per cent of the third semester and more than 90 per cent of the fourth semester be devoted to job-type activities.

**DEVELOPING SPEED AT JOB-TYPE ACTIVITIES.** To achieve real production proficiency the emphasis must be increasingly on turning out a quantity of work during a continuous and uninterrupted period. This work must be increasingly evaluated on the basis of job standards. The teacher who puts a premium on speed at these activities (by grading for speed as well as for quality) will achieve gains in stroking power. The teacher who attends only to quality of work on job-type activities and who, other things being equal, does not reward the faster worker will have little to show by way of gain in stroking power.

**DISTRIBUTION OF PRACTICE AT JOB-TYPE ACTIVITIES.** One of the most strongly established principles for learning is that distributed practice is, in general, better than massed practice. Accordingly, schedules for an entire course of training should provide for several cyclical go-rounds over the various sorts of job-type activities. Instead of devoting some single block of time to letters, another block of time to tables, and so on, it is decidedly preferable for work on letters, on tables, on manuscripts, and on each other sort of job-type activity to recur periodically throughout the course of training. In each new cycle, of course, the items typed should be more difficult or more extensive than those typed in the earlier cycle. The standards of performance, with respect to both speed and quality, should also rise with each new cycle.

## EVALUATION OF PERFORMANCE

No matter what the typing teacher may state as his objectives of training and no matter what the content and methods of his instruction, his real objectives are embodied in the content of his tests, in the conditions of test administration, and in his test scoring procedures.

Testing is a more highly technical matter than one might imagine, and a great deal is known about the necessary conditions for good testing. Some of the conventional testing procedures in typewriting seriously violate

established testing principles. Others fail to consider available information on the characteristics of various kinds of typing performances that could furnish a sound basis for good testing practices. This is especially unfortunate for a learning task in which objective measures of performance are so much more readily made than in most other school subjects. The recommendations which follow are based (a) on basic principles for testing and (b) on data specifically available in typewriting.

## Straight-Copy Work

1. It is inappropriate either to select the best of several performances or to use repeated tries at the same test copy—because test reliability is thereby lowered. Instead, use the sum (or average) of all performances—*each on different copy*—on any given testing occasion.

2. One 2- or 3-minute timing furnishes an adequate measure of a person's stroking *speed,* and longer timings are not necessary when the objective is merely to determine the status of students in relation to each other. The student's ranking for speed on a short timing will very closely approximate his ranking on a longer timing. However, if some objective of training is stated as the ability to type at X wpm. for Y minutes, then the proper measure of that objective is a test that is Y minutes long. (The necessary distinction is between rating students relative to each other as contrasted with measuring the attainment of a specified minimum standard.)

3. Both in an absolute sense and relative to measures of speed, number of errors in straight copy work is notoriously unstable. There is no possibility of getting a reliable measure of a person's accuracy in straight copy work in just one brief timing. Even the sum (or average) of performances on three 5-minute timings (even when on different test copy) furnishes a rather shaky index of straight copy accuracy.

4. Fortunately for the sake of economy of class time, early speed is such an excellent predictor of later speed and early errors such a poor predictor of later errors,

that a dependable measure of straight copy accuracy is probably not worth the investment in testing time. A good scoring system gives so little weight to straight copy errors that the poor reliability of measures of errors in brief timings is of little consequence.

5. Because speed and errors are essentially unrelated, speed and quality should *never* be combined into a single composite score arrived at by subtracting a single arbitrary penalty for errors from a speed score. One should avoid net wpm. or any other system (a) which measures neither speed nor errors in any clear fashion, (b) in which a given score can represent many different possible combinations of speed and number of errors, (c) which applies the same error penalty at all speeds, and (d) in which the absurdity of a negative score is possible. (Correct words per minute, CWPM, is rather less objectionable than net wpm. only because the penalty for errors in CWPM is so negligible that the resulting measure is mostly a measure of speed anyway.) Speed and accuracy should be scored separately.

a. In straight copy work, the proper measure of speed is gross words per minute, and the proper measure of accuracy is *number* of errors (or some measure of error rate, such as errors per minute). The only presently available basis for an overall measure of both speed and errors in one number is one which penalizes for errors in accordance with the number of words that could be typed in the time it would take to erase and correct errors. This has been done in the tables prepared by Balsley in which, on an estimate of 26 seconds as the average erasing time, each person's performance is computed to show his output had he erased and corrected errors. Without these tables, speed and number of errors must be scored separately. Those who recognize the weakness of the conventional composite scores and who attempt to solve the difficulty by having students actually erase during straight copy timings misconceive the intrinsic purposes of straight copy testing and contaminate what should be a measure of stroking power with, among other things, a measure of erasing skill.

6. ***Straight copy accuracy and the quality of work done on job-type activities are not related.*** For exactly this

reason, straight copy work's only defensible function is as a measure of stroking *power,* that is, gross speed. This is the only aspect of straight copy performance that has sufficient reliability or long-term stability.

7. One should *not* base grades on "improvement." The plain fact is that gains are harder to achieve as level of skill increases. Grading on the basis of improvement overrewards those at the lower levels of skill (for whom gains are readily achieved) and penalizes the better typists (for whom gains necessarily accrue more slowly).

8. Final grades should *not* be based on an average of performances over an extended period of time but on final performance. Stroking skill is developmental and cumulative, and it makes no difference by what route or with what delays and difficulties en route students may have reached whatever their level of proficiency may be at the end of any given semester or year.

9. In order for changes in straight-copy scores to represent true gains in skill as training progresses, it is essential for *testing* purposes (as apart from skill building *practice*) that (a) test materials be of comparable difficulty, as measured, for example, by syllabic intensity and that (b) tests be of *identical* length—say, five minutes.

10. It may be repeated that as a component in *final* examinations including other items, straight copy proficiency should be given decreasing weight as training progresses.

Nothing said here about errors in straight copy work should be construed to suggest that quality of typing work is of no consequence. Nothing could be further from the truth. Instead, the point is that errors in straight copy work have been shown to have no apparent relationship to any sort of subsequent performance. One simply is not measuring the attainment of the ultimate objectives of training (or predicting subsequent job performance) when he gives much if any weight to number of errors made in straight copy work. Employers who test job applicants on straight copy work should give performance tests on job-like problems. Straight-copy tests do not provide a sufficient basis for evaluation. (The Civil Service Commission uses straight copy tests presumably because the expense of *scoring* more realistic performances is too formidable.)

## Job-Type Activities and Production Tests

1. Tests of proficiency on job-type activities will be most valid when test content and test conditions parallel job content and job conditions. This means that errors must be erased and corrected and that the test items must be comparable in general appearance, in length, and in difficulty to those one meets on the job as an employed typist. If, for some item, four carbon copies are typically made on the job, then four carbons should be called for on the test. If, for some item, it is typical for employed typists to type from longhand, then the test item in school should be in longhand. If some typists must correct the boss' spelling errors and punctuate for him, then at least some school testing should require that the typist locate intentional misspellings and other errors in the original copy. Some real typing jobs involve making exact copies of materials already arranged. However, as a measure of mastery over jobs in which the typist must make the decisions about form and arrangement, test materials calling for direct copying are inappropriate. The basic principle is this: make the test item and the test conditions as much like the real-job item and conditions as possible.

2. The chief factor affecting the dependability or reliability of any test is its length. A business correspondence test with three letters, for example, will furnish a more accurate measure of a person's proficiency at that task than a test containing one letter. Similarly, for other typing activities—for which it is sometimes preferable to use one long item of a given kind and sometimes preferable to use several shorter items of that kind (e.g., one long manuscript, perhaps, but three short tables).

3. Scoring of performance at job-type activities is a troublesome matter often necessitating some artificialities that would not exist in an employment situation. The quality of work is usually of vastly greater importance than the speed at which it is done. At the same time, any scoring system which grades only for quality ignores the fact that, other things being equal, the fast worker is preferred to the slow one. All scoring systems should take speed of work into account.

a. Words per minute is not always a useful measure in scoring job-type activities for speed. When stroking is a major, and planning and decision-making a minor, component of some job (e.g., as in typing simple business correspondence) it is not inappropriate to use words per minute as a measure of rate. When (as in typing tables) decisions as to layout and form are the prominent component and the actual amount of stroking involved is often relatively trivial, then words per minute is not a particularly meaningful concept, and it is often more convenient and less misleading to measure speed in terms of completion time (to the nearest quarter-minute, for example). There is no necessary reason why all performances should be measured in the same unit, and one should choose whatever unit is appropriate to the nature of the task. A recent tendency to express performance and to set standards for job-type activities in words-per-minute terms and as a percentage of one's wpm. straight copy rates is to force some of these performances into a mold they cannot be made to fit.

4. It is generally preferable (but not always possible) to credit only work that is wholly free of error and to reject work that is unacceptable or unmailable. In that case the proper measure is "amount of acceptable work done in a given time" or "amount of time needed to complete a given body of acceptable work." Much of the time, however, work is of varying quality and it is necessary to score for differences in the quality of work. In such instances one sets up a penalty system (charging according to the seriousness of the error) to arrive at a quality score, entirely separate from a speed score. These two components are then given whatever weights one desires (according to one's training objectives at the time) before combining them into one overall score. (The concept of "net production rate a minute" is wholly objectionable because, by charging the same penalty for any sort of error, it erroneously assumes that all errors are equally serious. Further, by subtracting these penalties from a speed score, the result is a score which is mostly uninterpretable. A person credited with 32 NPRAM might have typed at 32 gross wpm. without error, or he might have typed at 44 gross wpm. and made 8 errors, say. In fact, if even one of his

errors is not correctible and the job must be redone, then his true rate is closer to 22 wpm.)

Any proposed scoring system should be examined from the point of view of whether or not it indeed furnishes a reliable measure of what you really want to measure. That the measure be one that is also simple and economical to use is a last, not a first, consideration. Most of the widely used scoring systems in typewriting are indeed simple, but some of them seriously violate what is required for valid and reliable measurement.

## Standards and Bases for Grading

In *vocational* typing courses, the most meaningful standards are job-like standards applied to job-like activities carried out under job-like conditions. These are widely available, but varying, for some types of tasks (e.g., straight copy work), moderately well established for other types of tasks (e.g., simple correspondence), and mostly non-existent for others (e.g., tables). When a specified and widely acceptable job standard does exist, it is desirable to use that standard as the basis for a minimum passing school grade. Such standards are *absolute* ones.

On the other hand, for tasks for which there are no commonly agreed upon job standards and on which it is not easily possible to specify what minimum proficiency consists of, it is necessary to use *relative* standards. For example, the actual performance scores of a group on some task are arranged in order, and the performance of the middle person, whatever it may be, is taken to represent the average grade (C in a letter grading system, 5 in a numerical grading system where C = 70–79). Then, points are assigned to each unit of performance (each wpm. of speed, for example, or each quarter-minute of work time) above or below the middle value such that the score of the fastest person is (preferably) just short of 100 per cent.

For example, if the middle speed in a class is 24 wpm. and the highest speed is, say, 36 wpm., then by assigning two points for each wpm. above or below the middle speed—with 75 assigned to the middle speed of 24 wpm.

—the 23-wpm. typist gets a grade of 73 and the 36-wpm. typist earns a grade of 99. Similarly, if the average time to complete some table is 10½ minutes and the fastest time is, say, 7 minutes, then by assigning a grade of 75 to the 10½-minute typist and 2 points for each quarter minute above or below the average time, the person who needed 11 minutes would score 71; the 7-minute worker would score 103 (i.e., 100); the 9¾-minute worker would score 81, and so on. Note that points are assigned not to successive students but to successive speeds or completion times. For example, in the first of the two instances mentioned if no one has typed at 25 wpm., there will be no one with a score of 77; and the 26-wpm. typist would have a score of 79.

This is the basic process by which any relative scoring or grading system is established. However, the particular level of performance to which the C (or 75) grade is assigned will be more dependably determined if it is based on compilations of performance scores over a period of time from a number of teachers, from a number of schools, or from a number of school systems. A broader base for these scores requires, of course, that the test materials and test conditions used to establish the scores be highly comparable from teacher to teacher and from school to school. Saving this, the *process* is one any teacher can apply to his own classes if he wishes.

BASES FOR GRADING. Evaluation should be based entirely on typewriting performance. If some teacher wishes to feel that he is shaping some youngster's personality, that is his prerogative; but let him not suppose that he has any sufficiently accurate basis for evaluating students with respect to such attributes as neatness, sense of responsibility, etc. The place for such "evaluations" is the back of the student's central school record, and they should not be allowed to contaminate an evaluation of a student's typing proficiency. There is no evidence whatever to show either that an individual's school behavior with respect to personal traits will correspond to his job behavior or that such evaluations can be made reliably. For the sake of maximizing validity and reliability, let the typing grade represent typing proficiency alone. Leave

to casual anecdotal report behaviors too shakily measurable to justify quantification.

A comparable argument may be directed against the practice of grading students on "typing technique." On the one hand, there is a confusion of means with ends and a failure to realize that if a student's technique is poor, it will be evidenced in his typed product, which can be scored accordingly. In addition, except for grossly poor techniques, there is little possibility of reliably evaluating the hard-to-see and hard-to-hear aspects of operation ordinarily incorporated into so-called technique rating charts and scales.

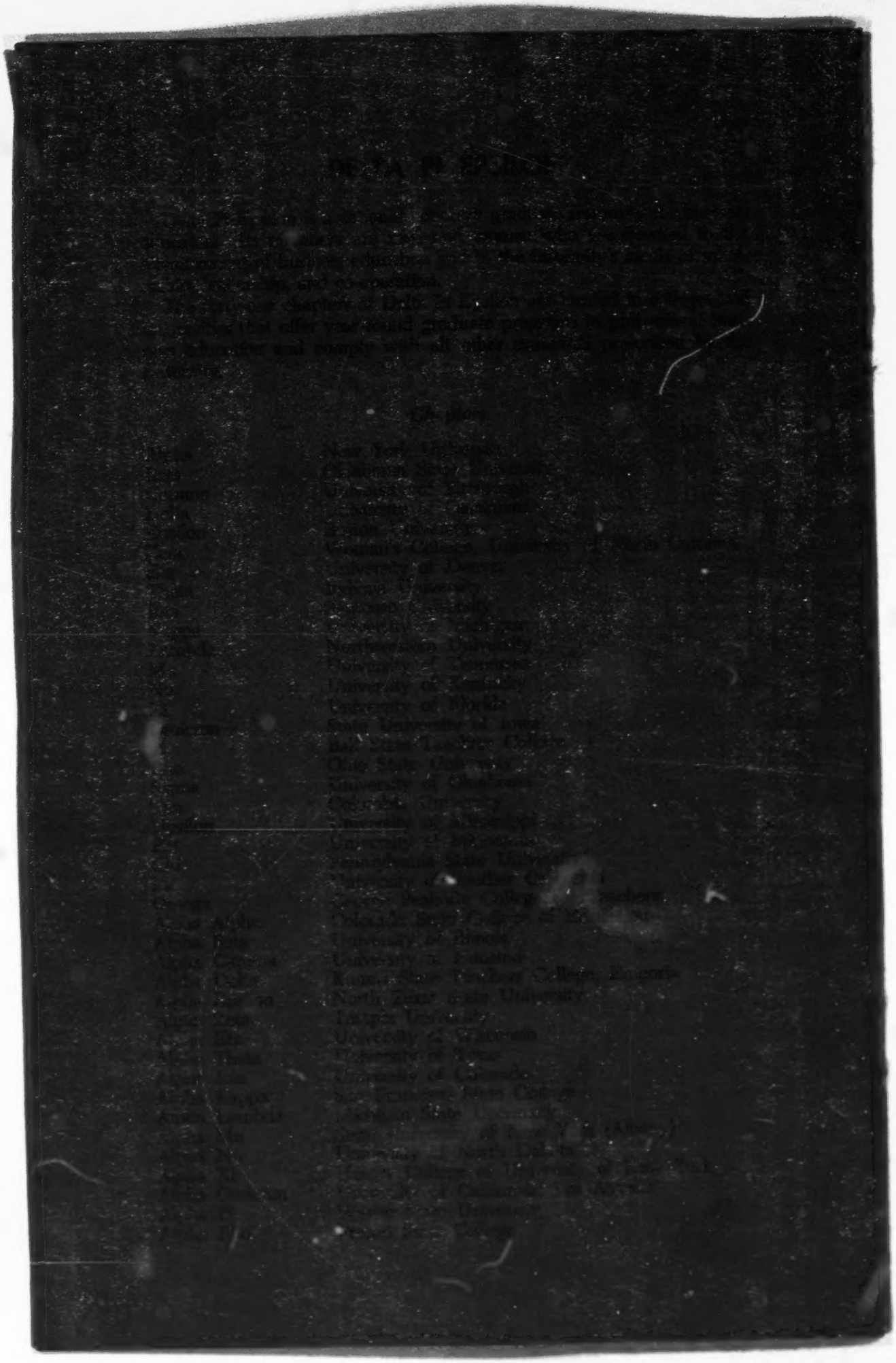
## SUMMARY

A small number of concepts underlie virtually all of human learning. These pervasive concepts, plus a few that relate particularly to learning sensory-motor skills, are the real bases for identification and derivation of effective materials and procedures for typewriting instruction. For any given learning task it is a matter of "translating" the basic concepts into specific procedures and of testing these "translations" (in the present instance) in the typewriting classroom.

Among the more important concepts applicable to the evaluation of any proposed instructional method are those of (a) transfer, (b) reinforcement, and (c) individual differences. School practice will transfer maximally to job performance to the extent to which the materials and conditions of practice duplicate job materials and job conditions. Concerning reinforcement, those procedures will be most effective that furnish the learner with immediate knowledge of results, immediate information as to the correctness of his responses. Procedures which withhold or delay reinforcement prevent or delay learning. Finally, those procedures will be best that avoid imposing any one behavior on all members of a class but, instead, permit each person to practice according to his individual needs and status at any given time.

Especially pertinent to sensory-motor skills like typewriting is the "discovery" principle. Description and

demonstration alone cannot be expected to be sufficient means of establishing good stroking habits and of acquiring higher-order habits. Major reliance should be placed, instead, on imposing practice conditions on the learner such that he "discovers" for himself the improved patterns of motions which define expertness. One such condition is the jamming of responses close together in time. Another lies in guiding the learner to type at that just-right rate at which more efficient rhythms can be "stumbled on."

As a means of identifying desirable instructional procedures reliance on one's personal teaching experience is quite inadequate. Such experience tends to be viewed with great subjectivity and, therefore, unreliability. The "tried and true" is not seldom more tried than true. The findings of high quality research constitute a superior guide for instruction, and a professional attitude requires, when indicated, a modification of one's teaching behavior in accordance with reputable evidence. It is hoped that the recommendations contained herein will furnish one basis for continuous improvement in the teaching and learning of typewriting.

# SELECTED REFERENCES